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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
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CHICAGO, IL 60604-3590

Mr. Johnny W. Reising  
United States Department of Energy  
Feed Materials Production Center  
P.O. Box 398705  
Cincinnati, Ohio 45239-8705

REPLY TO THE ATTENTION OF: SRF-5J

RE: Technical Review Comments on  
"Comparability of In-Situ Gamma  
Spectrometry and Laboratory  
Measurements of Radium-226"

Dear Mr. Reising:

The United States Environmental Protection Agency (U.S. EPA) has reviewed the above-referenced document as part of its oversight activities for the Fernald Environmental Management Project. The document, which is dated October 1997, was prepared by Fluor Daniel Fernald for the U.S. Department of Energy (U.S. DOE).

U.S. EPA's review of the document focused on its technical adequacy and consistency with other related documents. U.S. EPA found significant discrepancies in the document and has concerns regarding its technical adequacy. Although the data presented in the document indicates that a relationship between laboratory data and HPGe measurements for radium-226 may exist, too many uncertainties exist and too few significant data points have been used to make a determination of the acceptability of this relationship. Not enough information is provided in the study to reach a definitive conclusion regarding the comparability of HPGe measurements and laboratory data for radium-226. U.S. EPA's general and specific review comments are enclosed.

Please contact me at (312) 886-4591 if you have any questions regarding this matter.

Sincerely,

Gene Jablonowski  
Remedial Project Manager  
Federal Facilities Section  
SFD Remedial Response Branch #2

Enclosure

cc: Tom Schneider, OEPA-SWDO  
Bill Murphie, U.S. DOE-HDQ  
John Bradburne, FERMC0  
Terry Hagen, FERMC0

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Tom Walsh, FERMC0

bcc w/attachments:

Frances Barker, Tetra Tech

Scott Pastor, Tetra Tech

Jim Saric, SRF-5J

bcc w/o attachments:

Brian Barwick, ORC

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ENCLOSURE

TECHNICAL REVIEW COMMENTS ON "COMPARABILITY OF IN-SITU GAMMA SPECTROMETRY AND  
LABORATORY MEASUREMENTS OF RADIUM-226"

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

(Four Pages)

TECHNICAL REVIEW COMMENTS ON "COMPARABILITY OF IN-SITU GAMMA SPECTROMETRY AND  
LABORATORY MEASUREMENTS OF RADIUM-226"

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

GENERAL COMMENTS

Commenting Organization: U.S. EPA

Commentor: Jablonowski

Section #: Not Applicable(NA)

Page #: NA

Line #: NA

Original General Comment #: 1

Comment: The text presents a comparability study of laboratory measurements and in situ gamma spectrometry measurements for radium-226 and introduces a quadratic relationship between the laboratory and field data. However, uncertainties exist and thus the results of the study should be considered preliminary. First, the quadratic relationship is primarily based on only five data points that exceed 2 picocuries per gram (pCi/g). In addition, the study shows that as the radium-226 activities in soil reflected in high-purity germanium (HPGe) field measurements increase, the "true activities" reflected in laboratory measurements increase exponentially. It is assumed that laboratory measurements would be considered "true" because HPGe measurements are corrected to coincide with them. Therefore, minor fluctuations in HPGe measurements above 2 pCi/g will result in larger fluctuations of the "true activities." Moreover, with regard to the minor fluctuations, the total propagated uncertainty (TPU) of the HPGe system is not introduced. The text should be revised to describe the development of an algorithm that incorporates the HPGe TPU.

Commenting Organization: U.S. EPA

Commentor: Jablonowski

Section #: NA

Page #: NA

Line #: NA

Original General Comment #: 2

Comment: The text summarizes the results of the comparability study. However, no conclusions can be drawn regarding the comparability of HPGe field measurements and laboratory data for areas that exhibit radium-226 concentrations near the final remediation level (FRL) of 1.7 pCi/g. Review of data provided in Table 3 and the algorithm provided in Figure 7 raises several concerns. Of the 17 samples collected that correspond to the 1 meter above ground measurements, 7 samples had laboratory alpha spectrometry (AS) weighted means within plus or minus 50 percent of the FRL. Although none of these values exceeds the FRL, the HPGe measurements provide ambiguous results when the correction algorithm is used. These results are summarized below in increasing order with respect to weighted AS means.

Area	AS Means (pCi/g)	HPGe Results (pCi/g)	Corrected Results <sup>a</sup> (pCi/g)	
PBC-04	1.1	0.8	1.2	1.4
PBC-05	1.2	0.73	1.1	1.3
PBC-06	1.2	0.8	1.2	1.4
PBC-14	1.2	0.78	1.2	1.4
PBC-07	1.26	1.03	1.7	1.9
PBC-13	1.5	0.94	1.5	1.7
PBC-15	1.6	0.78	1.2	1.4

Note:

- <sup>a</sup> Two results are provided for the corrected results. The left column is based on use of the correction algorithm provided in Figure 7. The right column presents results corrected using the data provided in Figure 4 for the 1-meter measurement only. Further discussion of concerns regarding the correction algorithm is provided in Original Specific Comment 3.

Based on the corrected results listed above, little or no correlation between the AS data and HPGe measurements exists at the 1.7 pCi/g activity level. To fully evaluate a correlation between AS data and HPGe measurements, additional data points should be selected that reflect radium-226 activity levels close to (and both above and below) the 1.7 pCi/g FRL value. The text should be revised to address this issue.

Commenting Organization: U.S. EPA

Commentor: Jablonowski

Section #: NA

Page #: NA

Line #: NA

Original General Comment #: 3

Comment: The text states that the results of the study of the environmental influences on radium-226 detection will be issued in a separate report. Because the HPGe system relies on detecting radium-226 daughters, the largest uncertainties are associated with the physical and environmental conditions at the locations where measurements are taken. In addition to soil moisture content and weather conditions, the type of soil present is an important consideration. For example, silts and sands may have higher radon emanation rates than clays. Furthermore, the radon emanation rate would be a function of the contamination at depth in the

soil. If radium-226 exists at 1 foot or more below grade in nonporous or tight soil, the radon emanation rate to surface soil would be relatively low, reducing the chance of detecting the radium-226. Further discussion of these uncertainties should be provided in subsequent reports.

Commenting Organization: U.S. EPA

Commentor: Jablonowski

Section #: NA

Page #: NA

Line #: NA

Original General Comment #: 4

Comment: Although the data presented in the comparability study indicates that a general relationship between laboratory data and HPGe measurements for radium-226 may exist, too many uncertainties exist and too few significant data points have been used to make a determination of the acceptability of this relationship. For example, if the HPGe system was placed in various locations within a heterogeneous environment, it is not clear whether the algorithm provided in the study would work in each instance. If the HPGe system were placed directly over a hotspot, for example, the corrected activity could be determined to be many times greater than the activity that actually exists over the entire scanned area. In other cases, if the system were placed over a low radium-226 activity area with higher activities at the periphery, the corrected activity determined for the area could be much lower than the activity that actually exists. Not enough information is provided in the study to reach a definitive conclusion regarding the comparability of HPGe measurements and laboratory data for radium-226.

#### SPECIFIC COMMENTS

Commenting Organization: U.S. EPA

Commentor: Jablonowski

Section #: NA

Page #: 3

Line #: 6

Original Specific Comment #: 1

Comment: Except for Area PBC-02, the total dissolution preparation method using nitric/hydrofluoric acid indicated higher activities in low activity areas than the previous soil digestion technique. However, no explanation of the Area PBC-02 anomaly is provided. Furthermore, the text states that the values provided for Area PBC-02 are the averages of the results of two separate analyses conducted using the same technique, but the results of each analytical run are not provided. The text should be revised to provide the results of each analysis. Moreover, the text should be revised to discuss the chemical composition of the soil in Area PBC-02 and other potential reasons for the anomalous results.

Commenting Organization: U.S. EPA

Commentor: Jablonowski

Section #: NA

Page #: 4

Line #: 23 to 26

Original Specific Comment #: 2

Comment: The text states that TPU is provided for in each analytical method. However, only counting errors were considered in determining uncertainties associated with the HPGe system. Because counting uncertainties and systematic errors are used to estimate the total propagated error, the TPU for the HPGe system is incomplete and should be further investigated.

Commenting Organization: U.S. EPA

Commentor: Jablonowski

Section #: NA

Page #: 7 and 8

Line #: NA

Original Specific Comment #: 3

Comment: The text provides a step-by-step example of how correction factors were calculated. The methodology outlined for the development of a correction factor appears to be inappropriate and should be reconsidered. Although it may be possible to develop a correction factor in the future, the logic of combining data in the manner indicated in the steps appears to be invalid. Clearly a large difference exists between 1-meter and 0.31-meter HPGe measurements; therefore, the results for these data points should not be combined. Furthermore, development of a correction factor using exact data points but excluding an outlier appears to be questionable. This approach constitutes a manipulation of data to fit an expected outcome and may not be appropriate. Instead, all data points should be considered in the development of a correction factor. In cases where an outlier exists, duplicate measurements should be taken in exactly the same area. The outlier could then be averaged with its duplicate measurement, and the averaged result could be used. Therefore, the only valid curves for developing a correction factor are those shown in Figures 4 and 6. However, given the sparsity of data and the outlier noted above, the uncertainty associated with any correction factor may be excessively large. Additional data points should be used in the development of correction factors, and the methodology outlined in the text should be reconsidered.

Also, until additional data points are used to develop the correction factors, the corrected results presented in the rightmost column of the table in Original General Comment 2, which considers only the data points in Figure 4, are the more correct estimates of radium-226 concentrations.